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edge is not, for the critical realist, an apprehension, this actual dynamic relationship between conscious organism and environment does not set him an unsolvable problem. Only to the naïve realist of the apprehensional tradition is this the case. And I must frankly assert that Professor Dewey, as a naïve realist, avoids it only because he refuses to crawl out of his blanket terms, experience and objective situation. After all is said, I honor the neo-realist for his dogged persistency.

What, then, is epistemology? It is the reflective science which studies the nature, conditions, and development of human knowledge in the light of the available facts. It begins with a reflective study of the individual's field of experience, his distinctions and views of knowledge, and passes gradually to an hypothesis which will best harmonize the known facts. Approaching epistemology in this manner, I have been led to raise myself from the level of natural realism to that of critical realism. The result has been a view of knowledge which meets the demands of modern science and fits in with a flexible naturalism.

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STRUCTURE¹

WE speak of the structure of buildings, poems, plants, animals, machines, states, and even atoms. The fact denoted by the term is of such importance for our knowledge and use of things that nearly all inquiry is devoted to the discovery of structure in specific cases. Moreover, this discovery has an obvious finality about it. Its explanatory value is high and satisfying. For whatever the end may be which any operation serves and whatever the cause may be which initiated the operation, our curiosity is largely satisfied and our efficiency is enhanced when we have discovered the structure to which the operation conforms. A watch may be made to keep time; if we ask why it keeps time, we are not satisfied by saying because it was made for that purpose by a watchmaker, but we are satisfied by knowing its structure. Having this knowledge we are able to increase the precision of watches. The eye may have been made in order that we might see, but, if so, we do not thereby understand vision. We understand it rather when we have discovered optical structure. Then, too, we are in a position to improve defective vision. The fact of structure is obvious. Illustrations of it, how-

¹Delivered at the meeting of the American Philosophical Association, December, 1916.

ever, even if they are trite, may serve to emphasize the fact in some of its apparent varieties.

The user of materials may do many things with them provided that his use of them conforms to their structure. This is well illustrated in any problem of maxima and minima, as, for instance, the problem of determining what areas may be enclosed by a line of given length. Here the particular areas are limitless in number, but they are all limited by a single principle. This principle defines precisely the structure to which the operation conforms and within which, so to speak, it is confined, so that we know that the minimum area is the line and the maximum area the circle. This illustration may be paralleled indefinitely. Proper selection from among the illustrations would lead to recognized sciences which set forth the discovery of the structures within which are confined the operations with which these sciences deal. Mechanics would be one of these sciences. And it is clear that no matter how much mechanics may vary in its concrete discoveries or in the terms and instruments it finds best suited to its use, it will not vary in its attempt to discover the structure to which the equilibrium and displacement of bodies are confined. So far as this structure is concerned our conception of what bodies "really" are seems quite irrelevant. They may be the concrete things we perceive them to be, they may be "masses of matter" or "congeries of sensations," they may be molecules, atoms, or what not, their equilibrium and displacement conform to a precise and definite structure. Mechanics thus testifies to the fact of a structure of a particular kind within which and subject to which numberless operations of a particular kind can occur.

Chemistry affords another example. Not only do elements combine in definite ways, but the same elements subjected to different structural arrangements seem to produce an almost limitless variety of compounds. Ultimately, all chemical structures may be discovered to be mechanical. In that event we should recognize a welcome scientific simplification and an extension of the domain of mechanics. Such a possibility ought not to be prejudged even if in many chemical operations time appears to be a different factor from what it is in mechanics generally. To the latter science time seems to be relevant only as it is measured in terms of simultaneous displacements, while in chemistry successive or genuinely temporal displacements often seem to be involved. Although a remark of this kind ought not, in the present state of our knowledge, to be accepted as final, it serves, nevertheless, to indicate the possibility that structures may be matters of time as well as of space.²

² "The present physical and chemical structure of organism must be explained not only in terms of atoms and molecules, but also in terms of the his-

Biology seems to confirm this possibility. It has advanced in recent years to remarkable determinations in detail of the structure of living beings and of their operations. Recent experimental work on heredity, instinct, growth, and descent has revealed to us what we may call living structures with a fullness hardly suspected fifty years ago.³ And it is these structures rather than any assumed vitalistic principles which, as we are wont to say, "accounts for" the variety of forms and operations. But since living is not something spread out in space, but something enduring in time, living structures seem to be characterized temporally in a way different from mechanical and chemical structures. A cell is not simply what it appears to be under the microscope. It seems to have also what we might call a suspension in time which can be ascertained only by allowing to it its proper duration. It is not only so much chemical substance encased, so to speak, in a particular mechanical structure, but it is also so many minutes or days of a specific kind of growth. Accordingly, its growing seems to be subject to a structure suspended in time fully as much as the displacement of its parts is subject to a structure extended in space. Conformably with the latter it may divide and conformably with the former its successive divisions result in a typical living form. In biology, therefore, we apparently meet with structures which, while they exhibit definite mechanical and chemical characteristics, exhibit also characteristics which can not be defined in these terms. These structures are of *kinds*; and when we exhibit definitely the kind in any instance, we point not only to a particular mechanical and chemical fact, or series of such facts, but also to a life history.⁴

Psychology, at present, is following the lead of biology, especially when the latter science deals with highly organized living beings. Many of the operations which we call mental are so evidently vital that a distinction between the mental and the vital is more often confusing than helpful. If we are to make a sound distinction at all, our considerations hitherto might lead us to make it in what we may call structural terms. In other words, if there are operations or activities of living beings which indicate a structure different from the mechanical, the chemical, or the biological, then we may tory of living matter upon the earth." Comstock and Troland, *The Nature of Matter and Electricity*, New York, 1917, p. 194.

³ See, for example, T. H. Morgan's *Mechanism of Mendelian Heredity* (New York, 1915), with its extensive references.

⁴ I suspect that it is a confused recognition of the fact of life histories, as different from one another as different chemical compounds, that leads so repeatedly to vitalistic theories in biology, just as it is the failure to recognize the structural character of life histories which makes many "mechanical" interpretations of life so unsatisfactory and so unconvincing.

have a means of distinguishing mental from vital processes which may be advantageous. Such a difference appears to be the fact, for we recognize a kind of structure which we call logical. Whichever of the current attitudes toward logic we may take, we seem to be confronted with the fact that the operations of thought are subject to a structure which is not like that involved in the displacement of bodies, or in chemical combinations, or in life histories. The syllogism may be an inadequate expression of this structure, but it is an historically instructive one and shows how different the structure of thought is from the other types of structure we have considered. Every examination of the operation of implying or inferring seems to show the same difference. Ideas and propositions, whether spoken or unspoken, are subject in their movement to structural principles as definite and precise as the principle involved in the simple illustration of the line and the area with which we started. And these principles have that kind of aloofness from time and space which we indicate by the ordinary word "mental" and the extraordinary word "transcendental."

The foregoing illustrations naturally suggest the generalization that a structure of some sort is characteristic of all operations universally. In other words, whatever else the world or the universe or "reality" may be, it is at least a structure or a system of structures. Or we may say that it has structure as something genuinely, universally, and metaphysically characteristic of it. Whether it has one structure or many will be left here unconsidered. We shall be content to follow the lead of our illustrations and say that it has at least spatial, temporal, and logical structures which may be reducible to one type, but which will be left here without any attempt so to reduce them. Nevertheless, we shall speak in what follows of the fact of structure generally without distinguishing its apparent kinds.

Structure is a discovery and not an hypothesis. Naturally the discovery in particular cases may be generalized for cases not yet examined, so that belief in the universality of structure becomes a controlling belief. It may lead us to refuse the supposition that there is any operation which is structureless. But we do not begin inquiry by first supposing that there must be structure and then find that our supposition is borne out by the facts. Structure is met with in quite a different way. It is met in action and practise, by setting one stone upon another, for instance, and finding that stones must be set in certain ways if they are to stand up as a wall. The fact found out in such ways as this imposes itself on us, so to speak, confronts us, obstructs us after the manner of a brute fact, so that we must regard it as belonging to the subject-matter into

which we inquire and as independent of the fact that we discover it by inquiry. If we apply to it the distinctness current in philosophical usage, we must say that it is objective and not subjective, that it is *a posteriori* and not *a priori*, that it is empirical and not transcendental. In short, it is not an hypothesis invented by the mind for purposes either of explanation or control. It is a fact discovered, and discovered like other facts, as, for instance, that Saturn has rings.

Consequently there are many philosophical considerations irrelevant to it and on which it in no way depends. Its status as a genuinely discovered fact is independent of realistic and idealistic theories. It confronts materialism and spiritualism equally and unequivocally. Every brand of epistemology must bow to it, no matter how each brand may attempt to account for it, since each brand discovers it first and attempts to account for it afterwards. These statements need no other evidence than the recognition that the philosophical considerations implied by them, if they deal with structure at all, deal with it as a discovered fact which they attempt to elucidate or explain. In that sense only are they at all relevant to it. But they are in no sense relevant to its obviousness, its obstructiveness, or its bruteness. Any of these philosophies may be entertained without any alteration in the fact of structure either as a discovery of a general nature, or as a discovery specific in characteristic details. It stands out thus as one of the absolute metaphysical facts to which all speculation is subordinate.

Although philosophers may busy themselves with attempts to explain structure, there is no explanation of it, if by explanation we mean the finding of a reason why it should be. Of course there is explanation in the sense of making plain what structure is in specific cases and even what structure is in general. There is explanation also in the sense of showing what consequences flow from the fact of structure itself. But there is no explanation in the sense of showing why there is structure or why there is structure of any particular kind. A watch has a particular structure by virtue of which it keeps time; but if we ask why it has that structure, it is difficult to make clear precisely what we mean by the question. We can hardly say that the watch has its structure in order to keep time or because it keeps time, for manifestly its structure and its time-keeping go together simultaneously and not successively—the one is in no sense because of the other or for the sake of the other. To be sure, watches have been made in order that time may be kept, and that fact may show us why watches have come to be, but it does not show us why a watch in order to keep time or in just keeping time, has a structure

of a particular sort. The discovery of what the structure of a time-piece is or has got to be, if time is to be or is kept, is a very ultimate kind of discovery. It does not lead beyond itself. And what is true of the watch is true generally. God may have made all things after the manner in which a watchmaker makes a watch, for the purpose of having certain things done, but his purposes could not explain to us why things have the structure they are discovered to have. His purposes explain only what uses of structure he has chosen. And so the discovery that all things have structure is a very ultimate kind of discovery. It is absolute because the consideration of origin is quite irrelevant to it. No matter how things have been produced nor when, no matter whether they were ever produced or not, structure is an absolute fact about them, the kind of fact that does not lead beyond itself. There is no explanation of it because it is the kind of fact that does not require explanation.

All this is saying again that structure is really a discovery and a discovery of an absolute kind. That is, the inquiries which lead to the discovery of structure terminate absolutely in that discovery. Has structure been discovered or not? If it has been discovered, that ends the matter. From which it is clear that structure is not imposed upon things, but is something constitutional to them, so to speak. A watch does not have its structure imposed upon it by its maker. Neither does anything else. This is really saying again that structure needs no explanation, that the question why anything has structure is an idle question, but it is saying it in another way. Since structure is a discovery it may, like other discoveries, often be a surprise. Historically it seems to have been a surprise when made on a large scale. That things are fluid, so to speak, structureless, a kind of flux without law or order, subject to whim and caprice is not an unnatural supposition, so that the discovery of structure may come as a surprise and may lead to the question how was structure imposed upon the flux? But the discovery of structure in any specific case always disposes of this question by showing its futility. No one who understands the structure of a watch is surprised by it. We may be surprised at what is accomplished by means of the structure before it has been discovered, but when it is discovered we are not surprised that these things are accomplished by its means. Put in its most general form, the idea is this: order and uniformity cease to be objects of surprise when once structure has been discovered. There is then no longer any motive for accounting for them. They are not imposed upon the flux, but the flux exposes them in its movement. Structure is thus evidently a metaphysical discovery absolute and final.

Knowledge of structure is an eminently satisfying kind of knowledge. It reduces impressions, opinions, convictions, and beliefs to what we call science. Never do we understand anything more completely and finally than when we understand its structure. Such knowledge is in the highest sense explanatory, because it leaves nothing to be explained. By that I do not mean that it puts an end to all intellectual interest or that the discovery of structure is not progressive. I mean rather that did we know the structure of things thoroughly, all our intellectual interests would become practical and inventive. Science would become dogmatic while art would flourish. Since such complete knowledge would enable us to predict the consequences of any structural combination, all our ingenuity would be employed in inventing new combinations adapted to secure desired ends. All arts foreshadow such an ideal and especially the mechanical arts. For even if the principles of the classical mechanics are now under suspicion it is clear that their acceptance as so much settled dogma has been marvelously fruitful in inventions for man's use and comfort. And so it is that knowledge of structure gives us the great desiderata of all knowledge, namely, science and prediction, on the one hand, and control in the interest of desired ends, on the other.

Such complete knowledge, even if attained, would probably not put an end to attempts to conceive existence generally in terms which will satisfy human aspiration. But these attempts would not increase knowledge or add a new department to science. They would not, therefore, be either needless or profitless. They would be instances of an art which transforms existence by refining, beautifying, and ennobling it as does a picture or a song. In a world where pictures are painted and songs sung, it would be quite ridiculous to say that the imagination ought not to leap to a vision of providence or of a moral order. For a knowledge of structure would show that poetry and religion, as clearly as anything else, are not miraculous, and that they are not unnatural. But it would show also that they are not scientific, and that they do not increase our knowledge. Yet they do beautify existence and enhance the control of it. They put into the world heavenly pictures, so that he who contemplates them may be the more at home in this physical world.

There is apparently little difference, if any, between structure and what is called substance by metaphysicians. The latter term is more ambiguous in its usage and has associated with it many conflicting ideas. Yet when we speak of substance as that which exists in its own right, or as that which persists through all changes, or that which is defined in its own terms, or that which stands under,

or as that which has attributes, or as that the knowledge of which is conclusive and final, we are using expressions which seem equally applicable to structure. Indeed, when the term substance is used to identify anything beyond the particular subject of discourse at any time, it seems to carry us to much the same conclusions as a consideration of structure carries us. But the term structure has the advantage of freeing us from many perplexing associations. To speak paradoxically it is less substantial. It means something absolute without meaning God. It means that without which nothing can be or be conceived without meaning something which should be eulogized or made an object of emotional attachment. It is more expressive than the term substance is of an ultimate fact actually discovered. But our habit of thinking of structure as something possessed by the world or by things, suggests the advisability of linking it more closely with the older term. For although we may say that a watch has a certain structure we do not thereby mean that the watch is more ultimate than the structure it is said to have. And so with the world—it does not possess its structure, but is rather its structure when we wish to express a final and absolute fact about it.

This linking of the terms structure and substance enables us to speak of structure more naturally as a subject to which predicates may appropriately be attached. We may then say not that the world has structure, but that structure is the world. In other words, the attempt to form a conception of all things together or to speak of the universe or nature generally is an attempt which does not successfully carry us to the recognition of a single complete and self-enclosed whole of things, but rather to the fact that however endless the succession of events may be, or however manifold the number of identifiable things may be, ultimately there is unity of structure. And it is this discovered fact of unity of structure rather than some supposed wholeness with nothing left out which may properly be called the world or the universe. We might then say that beyond structure there is nothing, without meaning that within structure everything past, present, and to come is already somehow included. We should mean rather that all there is to structure is completely knowable because structure is itself complete, but that it is the only thing of which this can be said.

Linked with this completeness of structure is its principal attribute—as I should like to call it, still using substantial terms. That attribute is inertia. I have already indicated that structure is discovered as a brute fact. It is met with not by way of hypothesis or conjecture, but by way of opposition or resistance. Everything that happens conforms to it, but it of itself does nothing. Our orig-

inal illustration is here again suggestive. The structural principle of the many areas is a principle to which each of them must conform. Figuratively speaking, it sets a limit beyond which they can not go. But it produces no single area, although an infinity of areas is producible. As over against them structure is absolutely inert. And this seems true generally. Structure is the inert principle of all existence. On this fact itself I do not now dwell, although the derivatives of it are interesting and illuminating. I wish rather to venture one further generalization, namely, the identification of structure with matter when matter is metaphysically conceived. When so conceived—and here again we seem forced into paradoxical statements—when so conceived, matter loses its material qualities. These qualities, like solidity, fluidity, *etc.*, as well as all the so-called secondary qualities, have long appeared to men as convertible into one another and to afford no absolute basis for exact determination. Even the conception of chemical elements is seriously attacked on both theoretical and experimental grounds. But the conception of structure remains intact and to this conception still cling the so-called primary qualities of matter like inertia and those which are only quantitatively and relationally expressible, like weight. If the materials of things are convertible, it seems evident that in no sense can any one of them be more final and primary than any other; but if all are convertible in terms of changeless structural principles, these latter would appear to give us just that absolute conception of an inert factor in existence which has long borne the name of matter. This proposed identification of structure with substance and with matter is here only suggested. I hope at another time to elaborate it.

Indeed the points put forward in this paper are all in need of elaboration. But it has occurred to me that they might prove suggestive as indicating a field of metaphysical inquiry apparently free from the controversial questions of much recent philosophy. The considerations here suggested seem to me to afford scope for inquiry and discussion independent of mooted questions about the truth of perception or the possibility of knowledge.

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THE FIRST ANTINOMY OF KANT

THE thesis of Kant's first antinomy is unsound because in the course of the proof a hypothesis is implied which contradicts the original hypothesis. The passage in the Meiklejohn translation runs as follows: